Aspartame and Cancer

Key Points

- A study of about half a million people, published in 2006, compared people who drank aspartame-containing beverages with those who did not. Results of the study showed that increasing levels of consumption were not associated with any risk of lymphomas, leukemias, or brain cancers in men or women. (Question 2)
- Researchers examined the relationship between aspartame intake and 1,888 lymphomas or leukemias and 315 malignant brain cancers among the participants of the NIH-AARP Diet and Health Study from 1995 until 2000. Development of these cancers was not associated with estimated aspartame consumption, refuting a recent animal study with positive findings for lymphomas and leukemias and also contradicting claims regarding brain cancer risk. (Questions 3 and 8)

1. Why was an aspartame study initiated?

Researchers* from the National Cancer Institute (NCI) initiated this research because an earlier study showed that female rats fed the artificial sweetener aspartame developed more lymphomas and leukemias than rats that received no aspartame in their feed (Soffritti et al. 2005; Soffritti et al. 2006). The risk of cancer in that study grew with the increased amount of aspartame given to the rats. Some of the dosages may have been relevant to human intake (as low as 20 milligrams per kilogram of body weight, which would be equivalent to a 165-pound person consuming about eight cans of diet soda).

Other questions regarding the safety of aspartame were raised by a 1996 report (Olney et al. 1996) suggesting that an increase in the number of people with brain tumors between 1975 and 1992 might be associated with the introduction and use of this sweetener in the United States. However, this report was later criticized by the scientific community for committing "ecological fallacy" (Ross 1998). Ecological fallacy refers to making a wrong conclusion about cause and effect in one person based on collection of data from a group of people; i.e., relating two things that happen at the same time, such as aspartame use and an increase in the number of brain cancer cases seen in a population, without examining whether individuals who consume aspartame also develop brain cancer.

2. What did the researchers find in this current study?

Researchers examined the consumption of aspartame-containing beverages among the participants of the NIH-AARP Diet and Health Study and reported that, in a comparison of people who drank aspartame-containing beverages with those who did not, increasing levels of consumption were not associated with an increased risk of lymphomas, leukemias, or brain cancers in men or women.

An increase in cancer risk was not found for the main subtypes of lymphoid cancers (Hodgkin lymphoma, non-Hodgkin lymphoma, and multiple myeloma), non-Hodgkin lymphoma subtypes (including small lymphocytic lymphoma and chronic lymphocytic leukemia, immunoblastic lymphoma and lymphoblastic lymphoma/leukemia), or non-lymphoid leukemias.

3. How was the study done?

NCI researchers examined data from the NIH-AARP Diet and Health Study to investigate questions about aspartame and risk for lymphoma, leukemia, and brain cancers. The NIH-AARP Diet and Health Study is an observational study where people provide information on a questionnaire about their recent intake of various foods and then are followed up for subsequent development of cancer. Specifically, about half a million AARP members (285,079 men and 188,905 women) who were 50 to 71 years old and living in eight study areas across the U.S. were given a questionnaire in 1995 and 1996. The participants were followed until the end of 2000 by linkage of their records with cancer registries that track the occurrence of new cancers.

The questionnaire inquired about consumption frequency and diet drink-type preference for three potentially aspartame-containing beverages (soda, fruit drinks, and iced tea), as well as aspartame added to coffee and hot tea. The researchers then computed daily consumption of aspartame, taking into account aspartame content, portion size, and consumption frequency of each beverage. The estimated aspartame intake was next compared with the occurrence of 1,888 lymphomas or leukemias and 315 malignant brain cancers to see if there was any correlation between intake and cancer.

4. What is the significance of the current study?

As the largest study of diet and cancer to date in the U.S., the NIH-AARP Diet and Health Study allowed researchers to examine even relatively rare cancers and their subtypes. The information on people's food consumption was collected at the beginning of the study and before anyone was diagnosed with cancer. This particular study design makes the findings more reliable because it reduces the chance that cancer patients remember their beverage consumption differently or report any changes after diagnosis.

Although this is how epidemiologic studies typically determine the relationship between diet and diseases, aspartame estimated this way may or may not reflect lifetime consumption. Also, most diet beverage consumers in the study drank moderate amounts of aspartame, ranging from none to 3400 mg daily -- and on average 200 mg daily -- which is a little over a can of diet soda. While this moderate consumption is reflective of the average consumption in the U.S., these findings limit any conclusions about cancer risk in people who consume very high amounts of aspartame.

5. Does the general population drink as much diet soda as the study participants?

The participants of the NIH-AARP Diet and Health Study were recruited from six states and two metropolitan areas around the U.S. that have highly reliable cancer registry data. Thus, the study participants are a good sample of older adults in the U.S. The study questionnaire included questions to identify consumers of diet beverages and aspartame users for coffee and hot tea, which is information rarely available in most large population studies. The average aspartame consumption among diet beverage consumers in the study was about 200 mg per day, which is similar to a survey of U.S. consumers done by the Food and Drug Administration (FDA).

6. Were there differences in the relationship between aspartame and cancer by racial group, ethnicity, age, or gender?

Researchers examined the relationship between aspartame and lymphoma, leukemia, and malignant brain cancers by different races and age groups and also in men and women separately, and found no difference from the overall finding. However, it should be noted that the study included older adults who were mostly whites.

7. Do animal studies of aspartame show the same results as human studies?

The NIH-AARP study findings match those of previous animal studies by the FDA and coincide with the conclusion of an earlier study on childhood brain cancers (Gurney et al. 1997).

Shortly before this most recent study of aspartame and cancer was published, the European Food Safety Authority reviewed the recent animal data and urged caution when interpreting results (The European Food Safety Authority 2006): "The increased incidence of lymphomas/leukemias reported in treated rats was unrelated to aspartame, given the high background incidence of chronic inflammatory changes in the lungs and the lack of a positive dose-response relationship."

8. What are some facts about aspartame?

- Aspartame, distributed under several trade names (e.g., NutraSweet® and Equal®), was approved in 1981 by the FDA after numerous tests showed that it did not cause cancer or other adverse effects in laboratory animals (Council on Scientific Affairs 1985; Flamm 1997; Koestner 1997).

- In the NIH-AARP Diet and Health Study, aspartame consumption ranged from 0 to 3400 mg per day (about 19 cans of soda at the high end; however, the upper limit is not absolute because investigators asked multiple-choice questions on frequency and the highest option was "6-plus times a day"). There are 180 mg of aspartame in a 12 ounce can of diet soda.

- The highest aspartame category in the NIH-AARP Diet and Health Study was "600 mg and above per day," or about three or more cans of diet soda; researchers also examined higher categories (more than 1200 mg per day or 2000 mg per day, which is equivalent to approximately seven to 11 cans of soft drinks daily) with fewer people and found similar results of no elevated risk.

- FDA's Acceptable Daily Intake (ADI) of aspartame is 50 mg per kilogram of body weight or about 3,750 mg (21 cans of diet soda) for an adult weighing 75 kilograms (165 lb). ADI is the amount of substance (e.g., food additive) like aspartame that can be consumed daily over a lifetime without appreciable health risk to a person on the basis of all the known facts at the time of the evaluation.

- The average aspartame consumption among diet beverage consumers in the NIH-AARP Diet and Health Study was 200 mg per day, or about 7 percent of the ADI, which is the same as a survey of U.S. consumers done by the FDA.

- An animal study that fed 0, 4, 20, 100, 500, 2500, and 5000 mg per kilogram of body weight of aspartame to rats saw lymphoma/leukemia increase in female rats, starting from about twice the risk with 20 mg per kilogram of body weight (a person weighing 75 kilograms or 165 lbs, consuming 1500 mg aspartame, or about 8 cans of diet soda) compared with a control group that was not fed aspartame.

* Lim U., Subar A.F., Mouw T., Hartge P., Morton L.M., Stolzenberg-Solomon R., Campbell D., Hollenbeck A.R., & Schatzkin A. Consumption of aspartame-containing beverages and incidence of hematopoietic and brain malignancies. *Cancer Epidemiol. Biomarkers Prev.* 2006. Vol. 15.

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8. Soffritti M., Belpoggi F., Esposti D.D., Lambertini L., Tibaldi E., & Rigano A. (2006) First experimental demonstration of the multipotential carcinogenic effects of aspartame administered in the feed to sprague-dawley rats. *Environ. Health Perspect.* 114, 379-385.

9. The European Food Safety Authority (2006) Opinion of the Scientific Panel AFC related to a new long-term carcinogenicity study on aspartame. *The EFSA Journal* 356, 1-44.

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Related NCI materials and Web pages:

- National Cancer Institute Fact Sheet 3.19, *Artificial Sweeteners and Cancer* (http://www.cancer.gov/cancertopics/factsheet/Risk/artificial-sweeteners)
- Cancer Causes and Risk Factors Home Page (http://www.cancer.gov/cancertopics/prevention-genetics-causes/causes)

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